eggs and the cytoplasmic granules of cells such as neutrophils. Certain foregut fermenting herbivorous animals, the ruminants, langur monkeys and a bird, the Hoatzin, have adapted lysozyme to be a digestive enzyme, helping liberate nutrients from within bacteria. These animals also have multiple copies of the lysozyme gene and they are expressed in the gastric tissues. These digestive lysozymes are adapted to function at a lower pH and are resistant to the actions of acid and pepsin. It was hypothesised that the same permeability changes in parasitised ruminants that lead to uptake of pepsinogen into the bloodstream would also lead to elevated levels of lysozyme. Lysozyme can be assayed quite simply by incubating samples with lyophilised *Micrococcus* bacteria and measuring the change in light absorbance over a 10-min period. Using a buffer pH of 4.5, the assay should measure the gastric form of the enzyme only. Using serum from a variety of parasitised and non-parasitised sheep, elevated serum lysozyme concentrations have indeed been observed in infected animals.

What can risk analysis offer to the field of veterinary parasitology?

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Risk analysis methods were used to investigate the value of individual carcass testing for the control of *Trichinella spiralis*. This was considered an important issue as *Trichinella spiralis* is effectively absent from commercial pigs in many countries. Yet many importing countries, and food safety authorities, still require individual testing of all pig carcases or widespread surveillance of pigs at slaughter.

In order to address this issue a quantitative simulation model was developed to compare individual carcass testing with alternative risk management strategies. The risk management options considered ranged from simple restrictions on the types of herds which could supply pig meat for human consumption to more complex integrated strategies involving rodent control and other measures. Testing all pigs and integrated control strategies both met the requirement, but at considerable cost and inconvenience. The simplest and lowest cost strategy (which excludes very few pigs) was to allow only pigs reared in confined commercial herds, without any carcass testing, to enter the food chain.

The results of this assessment were used by the New Zealand Pork Industry Board to make the case that New Zealand pig meat from certified farms be exported without individual carcass testing. Officials in Singapore have accepted this control strategy and chilled pig meat has been exported since September 2005. Concepts developed in this assessment will be extended to develop a risk-based system for assessing the *Trichinella* status of United Kingdom pig farms. The approach could also be adapted to evaluate risk management strategies for other food borne parasites.

The glyoxylate cycle in *Ostertagia* (*Teladorsagia*) *circumcincta*

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Ostertagia (*Teladorsagia*) *circumcincta* is a nematode parasite which infects the abomasum of sheep and goats. The utilisation of substrates for energy production in *O. circumcincta* is largely unknown. This parasite has been shown to consume oxygen, and have a full glycolytic and TCA cycle in both L_3 and adult stages, although the metabolism of carbohydrates in adults appears to be more geared towards an anaerobic pathway. As well as glycogen, *O. circumcincta* also contains high levels of stored lipid in both L_3 and adult stages, which could also be utilised to provide energy. However, the relative importance of glycogen and lipid for energy production is unknown: in the L_3, in which nutrient intake is thought to be restricted by the presence of the sheath; or the adult, in which lipid metabolism may be restricted by oxygen supply. The key enzymes of the glyoxylate cycle, malate synthase and isocitrate

lyase, have been detected in *O. circumcincta*, which would allow this parasite to convert lipid to glucose for metabolism via glycolysis. The enzyme phosphoenolpyruvate carboxykinase (PEPCK) has also been detected in both L_3 and adult *O. circumcincta*. Although this enzyme is typically associated with anaerobic metabolism in nematode parasites, it is also central to gluconeogenesis. As the *O. circumcincta* has a full TCA cycle and consumes oxygen, gluconeogenesis may be the key function of PEPCK in this parasite species, particularly in L_3s. The activity of the glyoxylate cycle along relative levels of glycogen and lipid in L_3 and adults of different ages will be discussed.

Development of free-living stages of *Ostertagia* (=*Teladorsagia*) *circumcincta* at varying temperatures

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AIM: to determine the development of *O. circumcincta* at varying temperatures, both constant and with a daily range representing summer and autumn.

METHODS: Faecal samples on each occasion were obtained from three sheep that had been experimentally infected with *O. circumcincta*. Three reps of 10 g of faeces/sheep were each placed in a 55 mm diameter petri dish which in turn were placed inside a 85 mm diameter petri dish containing 5 ml water. These were then placed inside an incubator, together with a large tray of water to maintain high humidity, at the following constant temperatures: 4, 7, 13, 17, 25 and 37°C. Not all temperatures were run contemporaneously. Faecal samples were harvested at intervals, suspended in surgical gauze in a 40 ml plastic conical beaker, covered with water and placed at 25°C. Larvae emerging by 24 h were counted. Faecal temperatures over a calendar year were measured every 15 min in an artificially created 220 g faecal pat on pasture placed either in permanent shade or in full sun. Faeces were replaced as required. The rate of larval development was measured in a variable temperature incubator using the mean temperatures in full sun for January and April.

RESULTS: The development success (range) were: 4°C (1–4%), 7°C (10–16%), 13°C (25–70%), 17°C (74–94%), 25°C (40–77%) and 37°C (0%). For January and April the mean daily ranges of temperatures were 14–32°C and 11–22°C, respectively. Development was maximal at 50–70% by Days 8–12 for January and maximal at 70–90% by Day 16 for April.

CONCLUSIONS: The optimal development temperature was about 17°C reducing to minimal development at 4°C and 37°C. Development was higher in April (autumn) than January (summer).

POSTERS

Small and large females occur in all nematode clades

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To investigate principles underlying adult body size in the Phylum Nematoda, the volume of females of 3150 species in 186 genera was calculated from length and width information. Genera were grouped using the rDNA-based clades of De Ley et al. While the volume of females in some of the clades overlap, there are typically distinct differences within clades between females that exist in living substrates and those that do not, the former invariably being larger. In all five clades (but not Chromadorida) females may achieve relatively great size, but diminutive forms are known from most clades and habitats. Bacterial-feeding is common in females in non-living substrates and the related females in living substrates, which may represent alternate generations, are often larger. If the females in both substrate classes are bacterial-feeding it may help understand the conundrum of whether those in living substrates are larger because they utilise better physical conditions or because they are required to produce more propagules. Apart from the use of clades, this survey of the phylum has not been controlled for phylogeny, and detailed studies could be made within clades. In particular, the effect of substrate, controlled through using species with alternate life cycles, should be suitable for investigation.